Results of forest insect and disease surveys in the EASTERN REGION of Ontario, 1989

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

A. Keizer

Miscellaneous Report No. 93

Forestry Canada Forêts Canada

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FORESTRY CANADA, ONTARIO REGION

Ontario Region is one of six regional establishments located across Canada and operated by Forestry Canada. The overall objective of Forestry Canada is to promote the preservation, enhancement and wise use of a healthy, attractive and bountiful forest resource and terrestrial environment for the economic and social benefit of all Canadians. Ontario Region pursues this objective by conducting two major programs: research and technical services and forestry development. Both programs address major problems affecting forest management and the forest environment primarily in Ontario, but because of the transprovincial nature of the forest resource, many elements of our research program are of national significance.

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RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE EASTERN REGION OF ONTARIO 1989

(FOREST DISTRICTS: NAPANEE, TWEED, CARLETON PLACE, and BROCKVILLE)

A. Keizer

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1990

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SURVEY HIGHLIGHTS

The following report summarizes forest damage by insects, diseases and abiotic agents observed in the Eastern Region of Ontario in 1989. Included are summaries of forest decline and dieback evaluations as well as special surveys, infestation forecasts and miscellaneous pests.

Reduced levels of cedar leafminer damage were offset by regional foliar "browning" induced by a multitude of stress factors. Thin crowns and branch-tip mortality were evident across the region; however, in most of the severely affected areas, new growth was evident as early as mid-June.

The forest tent caterpillar infestation which, when it first appeared in 1987, caused over 980 ha of moderate-to-severe defoliation, has increased considerably, causing moderate-to-severe defoliation over 438,919 ha of mixed hardwoods in 1989. Egg-band surveys indicate an overall decline in populations in 1990.

The area of moderate-to-severe defoliation caused by gypsy moth increased over 2.5 times (from the 28,070 ha infested in 1988 to 68,981 ha in 1989), primarily in oak forests. Egg-mass surveys completed by Ontario Ministry of Natural Resources (OMNR) staff indicate that high population levels will occur in the Tweed, Napanee, Carleton Place and Brockville districts in 1990.

Increased populations of the jack pine sawfly, eastern tent caterpillar and various bark beetles were found at numerous locations throughout the region, causing severe defoliation and mortality.

A special survey for pear thrips in sugar maple has revealed that this insect is prevalent across southern Ontario. It was identified at nine locations in the Eastern Region, although associated damage levels were negligible.

Six areas of hardwood decline, possibly drought-induced, were noted in five districts; the condition was aerially mapped over 10,991 ha.

Increased infection levels of white pine blister rust occurred in most districts and another infection by a beech bark disease was found in Presqu'ile Provincial Park.

Additional maple health surveys were conducted, with 10 additional plots being placed in urban and rural settings, to bring the total number of plots in this project to 20.

A number of special surveys were conducted, and evaluations are provided.

A. Keizer

Frontispiece

Most sugar maple (*Acer saccharum* Marsh.) branch mortality was found in high-use areas such as roadsides and laneways, where root compaction, exposure to salt, mechanical damage and other anthropogenic stresses are most likely to occur.

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INSECTS

Major Insects

Pine False Webworm, *Acantholyda erythrocephala* (L.)

A 1-ha plantation of 2.0-m red pine (*Pinus resinosa* Ait.) was severely defoliated for the third consecutive year on Lanark County Road 22 in Fitzroy Township, Carleton Place District. Whole-tree and branch-tip mortality has occurred (<1%) on occasional fringe trees. Average defoliation and webs per tree were lower this year (60% and 16, respectively, in comparison with 92% and 28 in 1988).

Single webs were also evident on scattered young red pine and white pine (*Pinus strobus* L.) trees up to 5 m tall in Sharbot Lake Provincial Park, Tweed District, and Frontenac Provincial Park, Napanee District.

Cedar Leafmining Complex, *Argyresthia aureoargentella* Brower, *A. canadensis* Free. and *A. thuiella* (Pack.)

In 1989, leafmining damage levels were reduced to light sporadic infestations located primarily in the Cornwall, Carleton Place, Brockville and Napanee districts. Foliar "browning" of eastern white cedar (*Thuja occidentalis* L.) induced primarily by climatic extremes occurred throughout the region, reducing the amounts of foliage available to leafminers and complicating assessments. Only early assessments were reliable because of the quick onset of foliar desiccation, which turned the green foliage to light red. Typically, leafminer damage assessed ranged from 1% in Oxford on Rideau Township, Brockville District, to 80% in a 5.0-ha stand in Madoc Township, Tweed District. Foliar damage averaged 52% in five stands, ranging in size from 1.0 to 3.0 ha, in Carleton Place and Brockville districts.

Mature cedar windbreaks at the G.H. Ferguson Forest Station sustained foliar damage ranging from 1% to 60%. The systemic-action insecticide Cygon was used as a control measure in late May and mid-August.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Provincial Situation

As predicted, budworm populations have increased over approximately 1 million ha of balsam fir (*Abies balsamea* [L.] Mill.) and spruce (*Picea* spp.), causing 6,239,636 ha of moderate-to-severe defoliation. This increase has reversed the declining trend of the past several years. Infestations have been confined primarily to forests in the Northwestern and North Central regions (Fig. 1). The area of defoliation

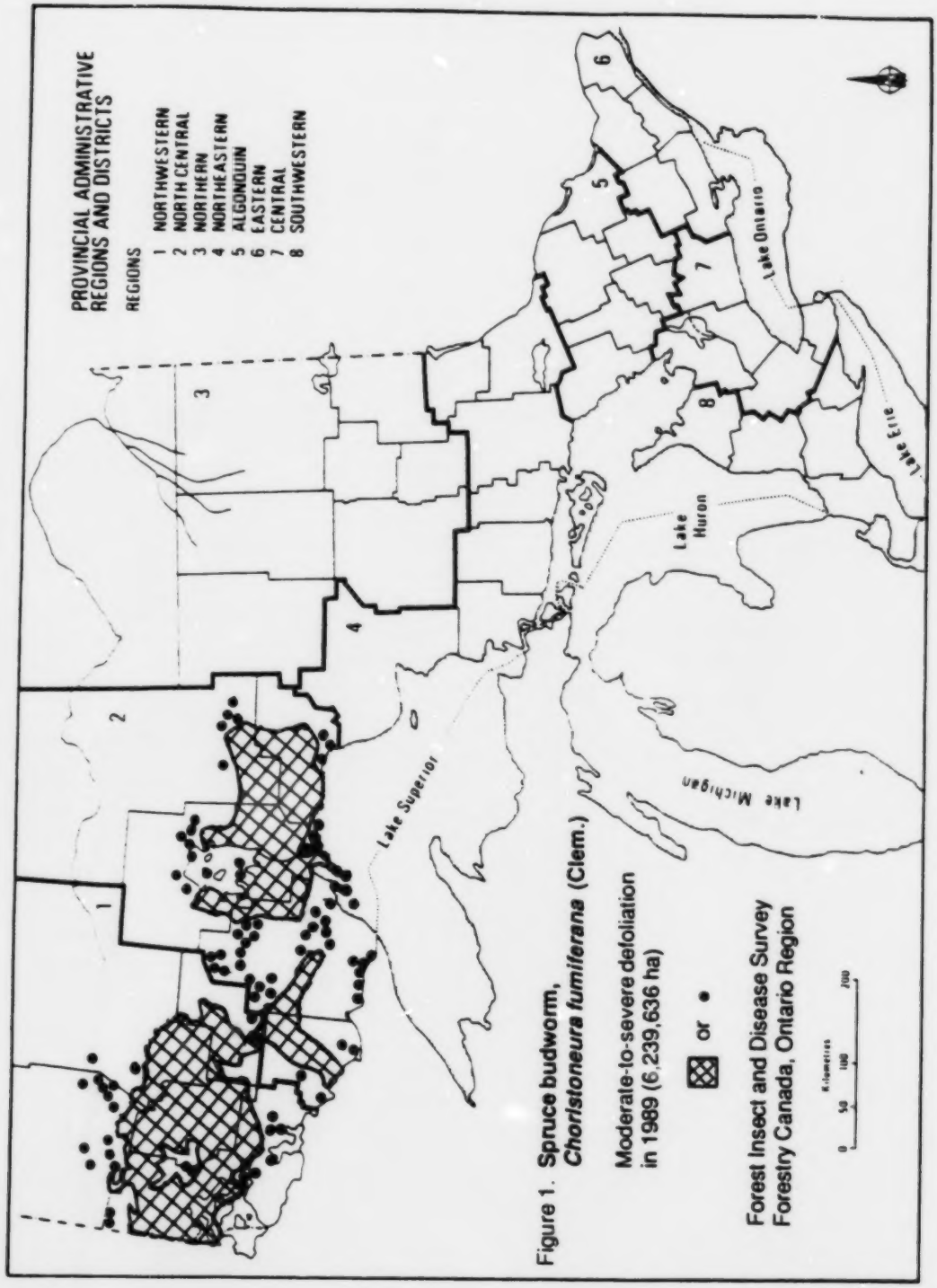


Figure 1. **Spruce budworm, *Choristoneura fumiferana* (Clem.)**

is much the same as in 1988. Increases occurred in 1989 in the Sioux Lookout and Kenora districts, Northwestern Region, and in the Thunder Bay, Nipigon, Terrace Bay and Geraldton districts, North Central Region.

In 1989, OMNR staff aerially sprayed 30,516 ha of spruce/fir forests in the Thunder Bay and Nipigon districts with the bacterial insecticide *Bacillus thuringiensis* (*B.t.*).

Eastern Region

All surveys in the Eastern Region, including light trap and pheromone captures, indicate that populations will remain at low levels in 1990. Pheromone traps set in Lovant Township, Carleton Place District and in Denbigh Township, Tweed District caught no adults, and a single light trap in Oxford on Rideau Township, Brockville District, attracted only three adults.

Birch Leafminer, *Fenusa pusilla* (Lep.)

Areas of foliar browning appeared to have decreased in 1989. Despite this trend, roadside and ornamental birch (*Betula* spp.) trees displayed up to 100% foliar browning in the urban areas of Ottawa, Kingston, Kemptville, Belleville and Brighton, and in Presqu'ile and Sharbot Lake provincial parks.

Fall Webworm, *Hyphantria cunea* (Drury)

Large numbers of webs and accompanying severe defoliation were observed in localized areas in the southern portions of the Brockville and Napanee districts. These areas consisted of small groups of deciduous trees, primarily ash (*Fraxinus* spp.), maple (*Acer* spp.) and cherry (*Prunus* spp.); they varied in size, and ranged in number from 2 to 18. Defoliation ranged from 2% (one or two webs per tree) to 100% (as many as 38 webs per tree). Most of these areas were in Oxford on Rideau Township along Highway 16, along the St. Lawrence River near the city of Prescott and along the St. Lawrence Parkway from Brockville to Gananoque, all in Brockville District. In Napanee District, webs and defoliation were observed along both sides of Highway 401. Single trees containing a few webs were scattered throughout most of the region.

Gypsy Moth, *Lymantria dispar* (L.)

For the second consecutive year an increase in moderate-to-severe defoliation increased in the Eastern Region; the total area defoliated in 1989 was 68,981 ha. The increase amounted to 40,911 ha, or approximately 2.5 times the 28,070 ha aerially mapped in 1988 (Fig. 2), and occurred primarily in the Tweed, Brockville and Napanee districts (Table 1).

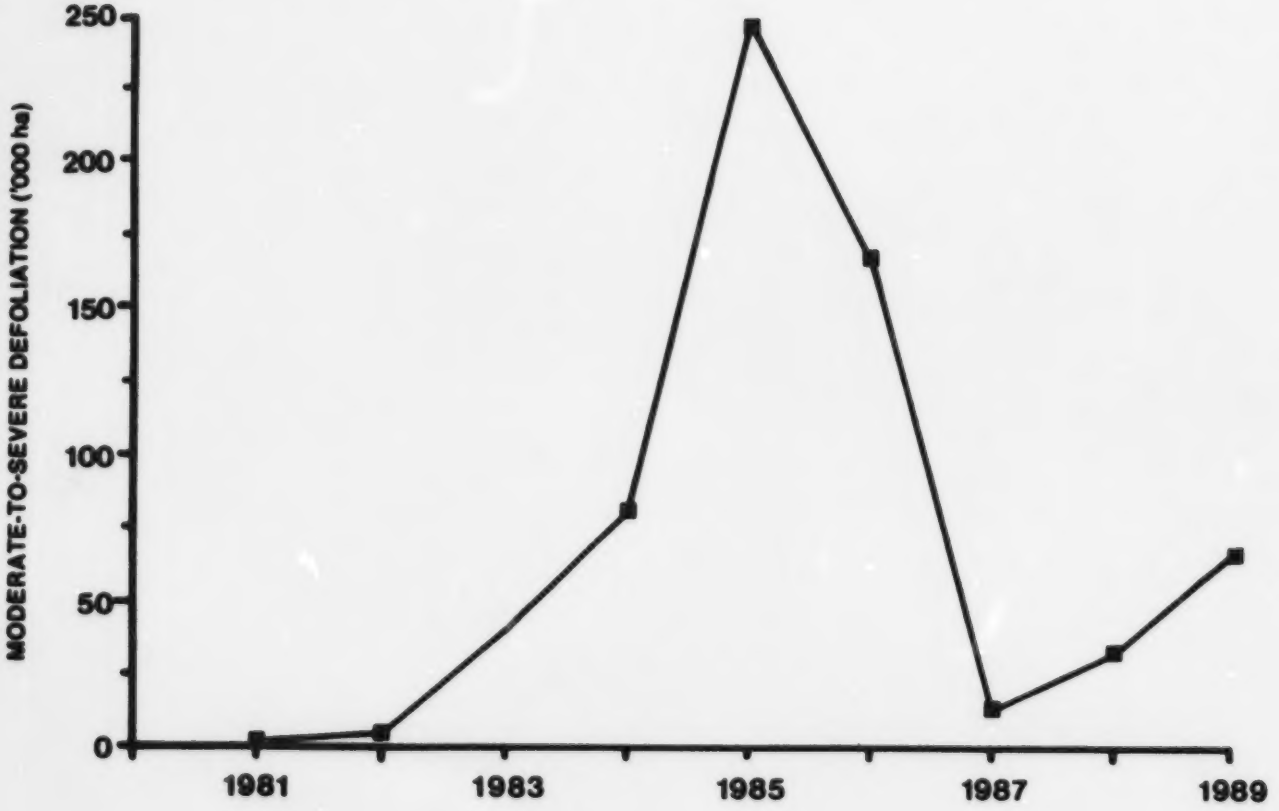


Figure 2. Yearly comparison of moderate-to-severe defoliation ('000 ha) caused by the gypsy moth, *Lymantria dispar* (L.), in the Eastern Region from 1981 to 1989

Table 1. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth in the Eastern Region of Cntario in 1988 and 1989 (by district)

District	1988	1989	Change	
			%	Area (ha)
Tweed	16,089	39,096	243	+23,007
Napanee	6,198	15,001	242	+8,803
Carleton Place	3,918	2,634	-33	-1,284
Brockville	1,865	12,250	657	+10,385
Total	28,070	68,981	246	40,911

The Tweed District contained 57% or 39,096 ha of the total area defoliated. New infestations occurred primarily in Lake, Tudor, Grimsthorpe and Madoc townships in the northeastern portion of the district and in Sheffield and Hinchinbrooke townships in the southeastern portion (Fig. 3, Table 2). Most of these areas were severely defoliated by the earlier-feeding forest tent caterpillar, *Malacosoma disstria* Hbn. (Fig. 4).

Napanee and Brockville districts contained 39% of the regional defoliation (15,001 ha in the former and 12,250 ha in the latter). Percy, Rawdon, Sidney, Murray and Seymour townships contained the majority of defoliation in the Napanee District, while Crosby South, Front of Leeds and Lansdowne, Front of Yonge and Front of Escott townships were infested in the Brockville District. Parts of the Napanee District infested by gypsy moth also experienced earlier feeding damage by the forest tent caterpillar, primarily in the northwestern portion of the district. The area of damage was reduced in Carleton Place District, where 2,634 ha were defoliated in Bathurst, Darling and Pakenham townships. This reduction of approximately 1,284 ha occurred primarily in Bathurst Township. In the St. Lawrence River area, Howe, Hill and Grenadier islands were reinfested. New infestations were aerially mapped on Tar, Club and Stave islands.

Egg-mass surveys performed by staff of OMNR and Forestry Canada, Ontario Region (FCOR) in the fall of 1989 indicate high populations for 1990. These areas of projected high populations are located in the northwestern portion of Tweed District and extend into northwestern Carleton Place District, western Brockville District and eastern Napanee District.

The average number of adults captured in pheromone traps placed at 14 parks (two per park) across the region has remained fairly constant, with 13.2 in 1988 and 14.9 in 1989 (Table 3). Burlap traps have revealed higher numbers of larvae at most locations trapped during the month of June. Once again, Sharbot Lake Provincial Park contained the highest number of larvae (2,159).

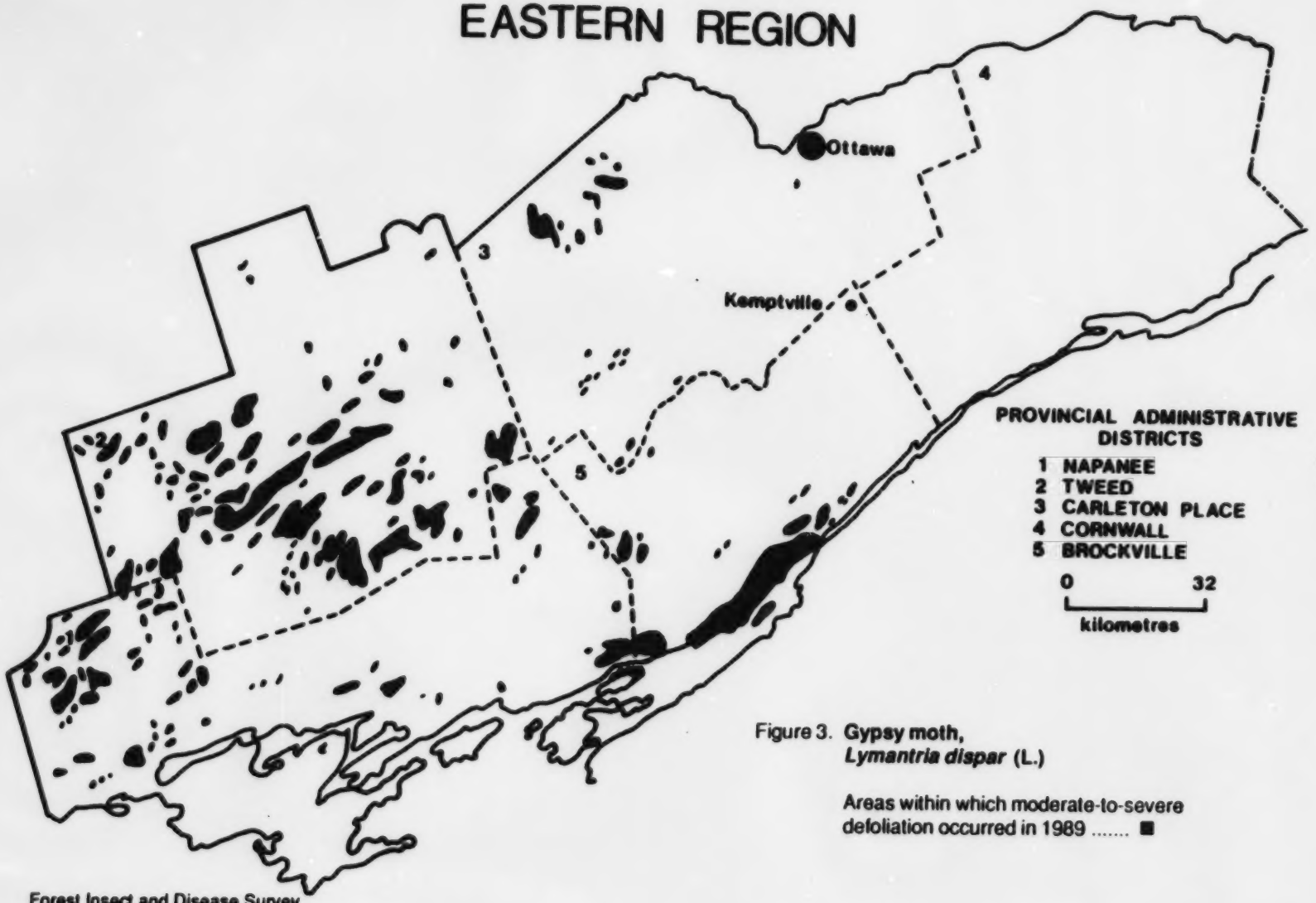


Figure 3. **Gypsy moth, *Lymantria dispar* (L.)**

Areas within which moderate-to-severe defoliation occurred in 1989 ..... ■

Table 2. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth in 1988 and 1989 (by county)

County	Area (ha)	
	1988	1989
Lennox and Addington	10,007	12.660
Northumberland	5,341	8,231
Hastings	5,625	22,262
Lanark	1,355	2,590
Leeds and Grenville	1,865	12,250
Frontenac	1,861	11,625
Prince Edward	0	340
Ottawa-Carleton	0	44

Eastern Tent Caterpillar, *Malacosoma americanum* (F.).

Large numbers of tents appeared throughout the region; cherry, apple (*Malus* spp.) and a variety of other deciduous hosts were defoliated. Host trees varied in size and damage levels varied as well, although the smaller regeneration was often 100% defoliated. Tents ranged in number from 1 to 25 per tree. Larger numbers of tents were found in Tweed District along Highway 7 in Oso, Olden and Hungerford townships; in Seymour and Kingston townships and Frontenac Provincial Park in Napanee District; along Leeds and Lansdowne County Road 14 in North Crosby Township, Brockville District; along Highway 401 in Elizabethtown Township; and through the urban areas of Ottawa in Carleton Place District.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

As expected, the area of moderate-to-severe defoliation by this pest increased in 1989, for the fifth consecutive year. The total area defoliated amounted to 438,919 ha, an increase of 3¼ times over the 125,644 ha recorded in 1988 (Table 4). This represents 21% of the total area defoliated in southern Ontario in 1989 (Algonquin, Central, Southwestern and Eastern regions). The largest area of defoliation was 1,319,956 ha in the Algonquin Region (Fig. 4).

The infestation has extended southward to the Eastern Region from central Ontario. Of the total area defoliated in the Eastern Region, 345,104 ha were in Tweed District. This area includes most of the mixed hardwood stands in the southwestern half of the Tweed District; in addition the infestation extended over 81,248 ha of the northwestern portion of the Napanee District. Scattered pockets occurred throughout both of these districts around the main body of infestation.

Table 3. A summary of the results of gypsy moth burlap and pheromone trapping and defoliation estimates at 14 parks in the Eastern Region of Ontario in 1989

Location (Provincial Park)	Burlap traps (10 per location)		Pheromone traps (2 per location)[a]		Avg defoliation estimates		Egg-mass estimate[d]
	Total no. of larvae		No. of male moths captured				
	1988	1989	1988	1989	Host(s)	%	
Brockville District							
Charleston Lake	298	314	24	16	sM, rO, tA, wB	5	6
Carleton Place District							
Fitzroy	584	b	28	14	rO, sM, tA, wB	10	4
Murphy's Point	0	269	20	17	rO, tA, wB	6	10
Rideau River	0	27	36	36	rO, tA, wB	6	0
Silver Lake	227	760	19	26	rO, sM, tA, wB	1	22
Cornwall District							
Carillon	0	0	33	36	wB	2	2
Jessup's Falls Conserv. Area	61	1,069	29	45	rO, tA, wB	7	2
Napanee District							
Ferris	b	b	24	49	Or, sM, tA, wB	64[e]	13
Frontenac	910	422	25	21	Or, tA, wB	20	20
Lake-on-the-mountain	0	378	18	38	maple	0	0
Presqu'ile	13	0	22[c]	31	rO	5	16
Sandbanks	31	125	34	30	rO, wB	2	2

(cont'd)

Table 3. A summary of the results of gypsy moth burlap and pheromone trapping and defoliation estimates at 14 parks in the Eastern Region of Ontario in 1989 (concl.)

Location (Provincial Park)	Burlap traps (10 per location)		Pheromone traps (2 per location)[a]		Avg defoliation estimates		Egg-mass estimate[d]
	Total no. of larvae		No. of male moths captured				
	1988	1989	1988	1989	Host(s)	%	
Tweed District							
Bon Echo	0	296	10[c]	24	rO, tA, wB	5	3
Sharbot Lake	1,195	2,159	21	34	rO, sM, tA, wB	12	2

[a] USDA Deltoid stick type

[b] data unavailable

[c] 1 trap missing

[d] avg no. based on 5-minute walk method

[e] includes forest tent caterpillar

In the Carleton Place District, 11,847 ha were defoliated, primarily in three areas: the Bathurst, Ramsay, and Pakenham/Darling townships. Scattered pockets were noted throughout the district.

Scattered pockets in the western portion of Brockville District totaled 720 ha. Cornwall District remained virtually free of severe defoliation.

Egg-band sampling among preferred hosts is used to forecast population levels. Table 5 indicates a general decline through most of the region in 1990.

Balsam Fir Sawfly, *Neodiprion abietis* complex

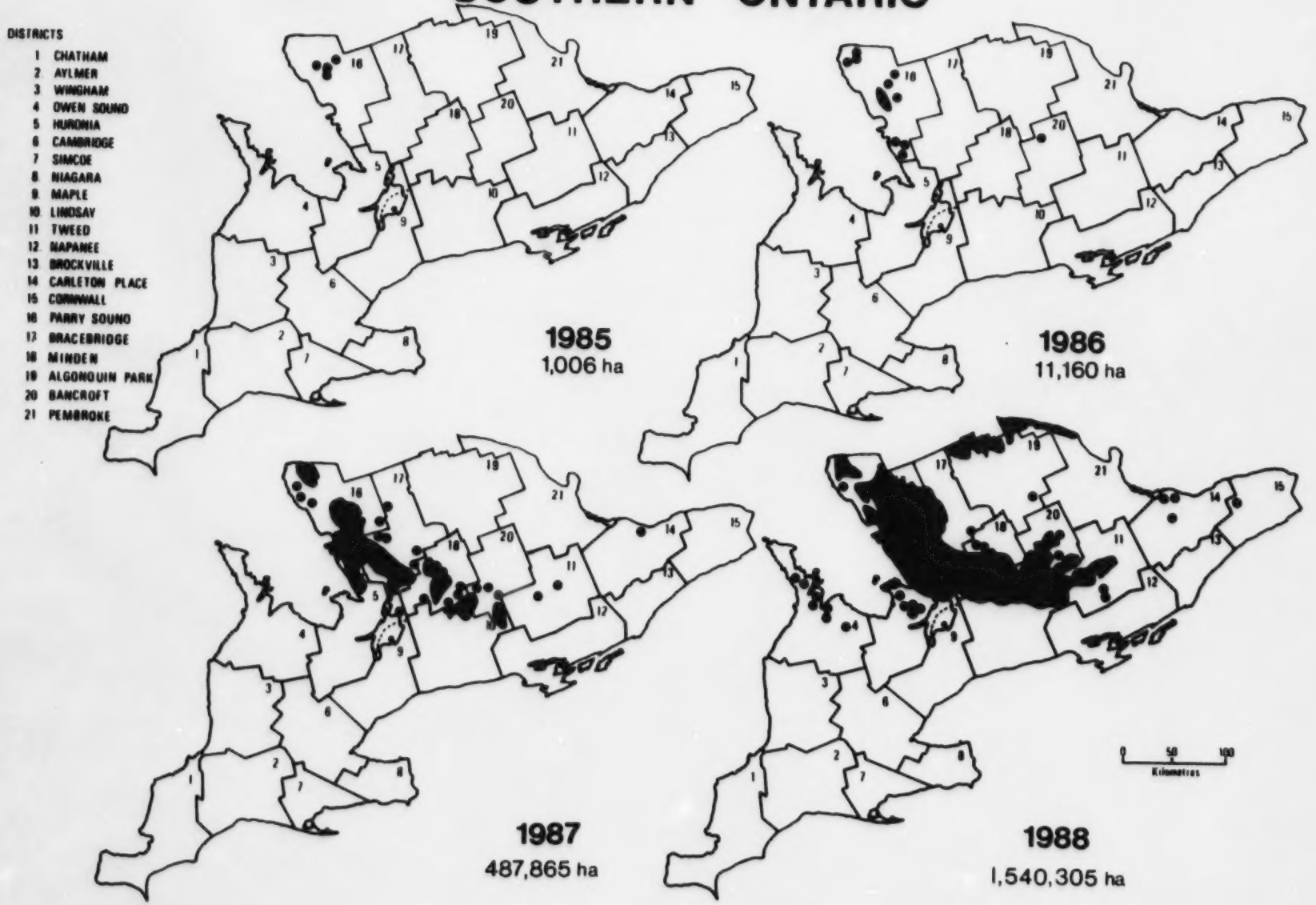
Increased levels of defoliation were evident on the upper crowns of scattered balsam fir trees, particularly in the Carleton Place District. Defoliation levels ranged from 10 to 25% in the following areas: along Ottawa-Carleton County Road 22 in Fitzroy Township, along Highway 15 in Beckwith Township and along a 2-km stretch of Concession IX in Drummond Township. Lighter damage (<10%) was observed less frequently through the Tweed and Brockville districts.

Jack Pine Sawfly, *Neodiprion pratti paradoxicus* Ross

Severe defoliation of jack pine (*Pinus banksiana* Lamb.) and Scots pine (*P. sylvestris* L.) occurred again in 1989 at numerous locations throughout the region. The heaviest damaged occurred in Montagne Township, Carleton Place District, where 1.0 ha of 3.5-m jack pine trees suffered an average of 80% defoliation per tree. In five additional jack pine plantations surveyed, defoliation ranged from 10 to 78% (Table 6). An 18-ha plantation of 2.8-m jack pine in Hungerford Township, Tweed District sustained severe damage for the third consecutive year, and associated light levels of branch mortality (<1%) are now evident.

Severely defoliated Scots pine and jack pine ornamentals were evident throughout the region. Areas containing higher densities of damaged trees were observed in Merrickville, Perth and Ottawa, Carleton Place District; near the town of Westport and along Highway 401 in Edwardsburgh Township, Brockville District; and near the towns of Chesterville and Cornwall, Cornwall District.

SOUTHERN ONTARIO



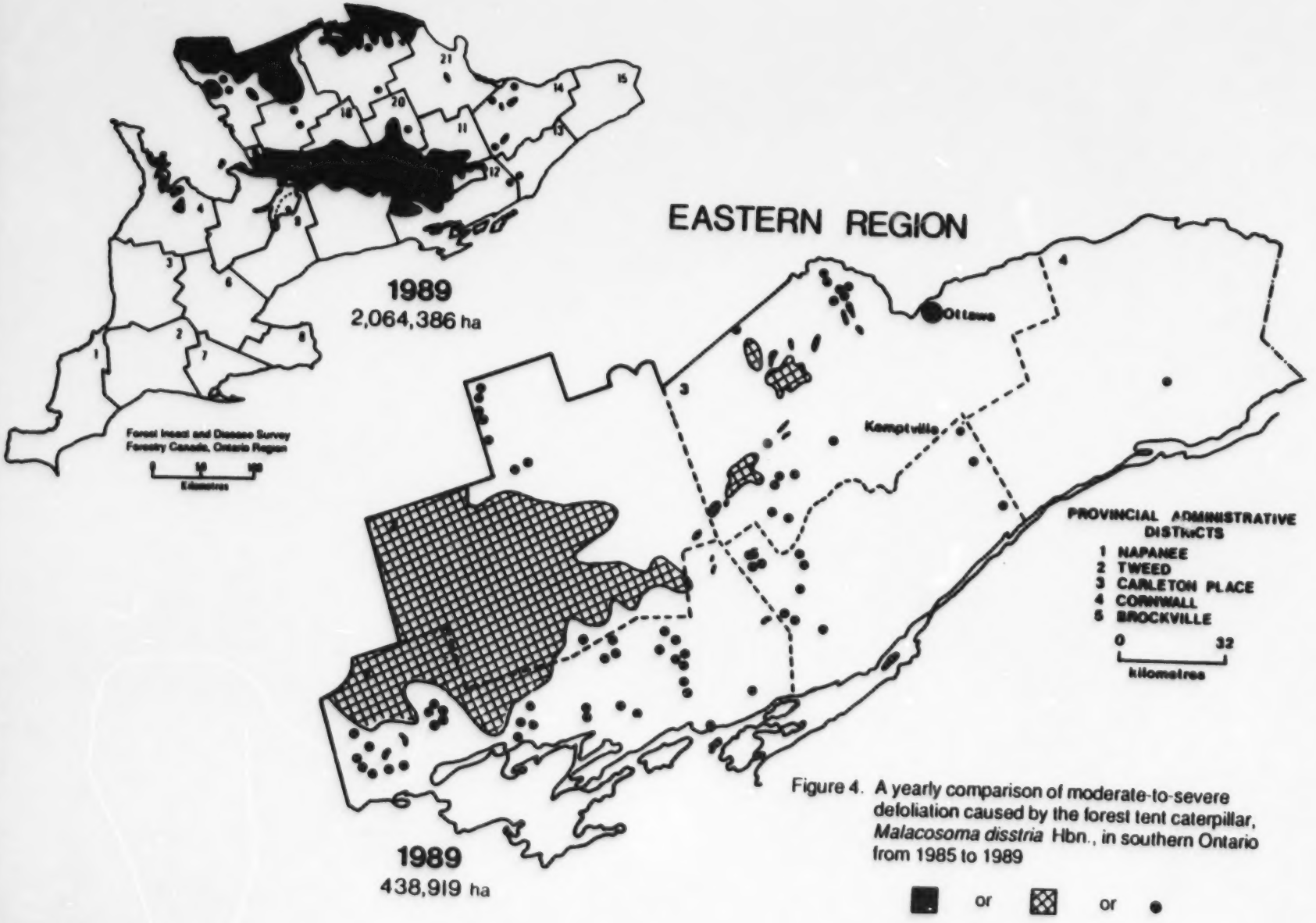


Figure 4. A yearly comparison of moderate-to-severe defoliation caused by the forest tent caterpillar, *Malacosoma disstria* Hbn., in southern Ontario from 1985 to 1989

Table 4. Gross areas of moderate-to-severe defoliation caused by the forest tent caterpillar in southern Ontario from 1985 to 1989

Region (District)	Area of moderate-to-severe defoliation (ha)				
	1985	1986	1987	1988	1989
Algonquin					
Bancroft	0	0	28,628	148,125	212,540
Minden	0	0	53,653	268,633	267,576
Parry Sound	1,006	11,160	241,399	408,302	390,886
Bracebridge	0	0	150,104	330,845	174,171
Algonquin Park	0	0	0	62,579	171,988
Pembroke	0	0	180	39,425	102,795
	1,006	0	473,964	1,257,909	1,319,956
Eastern					
Brockville	0	0	0	0	720
Cornwall	0	0	0	445	0
Carleton Place	0	0	78	3,835	11,847
Tweed	0	0	902	121,174	345,104
Napanee	0	0	0	190	81,248
	0	0	980	125,644	438,919
Central					
Maple	0	0	0	0	2,130
Lindsay	0	0	5,198	47,752	132,578
Huronia	0	0	7,723	104,240	124,513
	0	0	12,921	151,992	259,221
Southwestern					
Owen Sound	0	0	0	4,760	46,290
Total	1,006	11,160	487,865	1,540,305	2,064,386

Table 5. Forest tent caterpillar egg-band samples collected from sugar maple (*Acer saccharum* Marsh.) and trembling aspen (*Populus tremuloides* Michx.) in four districts of the Eastern Region in 1989, with infestation forecasts for 1990

District (Township)	Host	Avg DBH of tree(s) (cm)	Avg no. of egg bands per tree	Infestation forecast for 1990
Carleton Place District				
March	tA[a]	18	1	light
Bathurst	tA[a]	17	1	light
Bathurst	sM[b]	17	0	light
Brockville District				
Rear of Leeds and Lansdowne	sM[a]	17	1	light
South Crosby	sM[a]	20	1	light
Tweed District				
Kaladar	tA[b]	17	1	light
Napanee District				
Sheffield	sM[a]	20	1	light
Seymour	sM[a]	24	1	light

[a] whole-tree sampling
[b] branch sampling

Maple Leafcutter, *Paraclemensia acerifoliella* (Fitch)

Again in 1989, overall levels of defoliation were generally low throughout the region. Portions of Murphy's Point Provincial Park in Carleton Place District contained moderate damage, and 25% foliar damage was recorded on 20% of the trees over approximately 10 ha in Napanee District. Scattered roadside trees of all ages and sizes along Prince Edward County Road 12 in Hallowell Township sustained an average of 30% defoliation, and 80% of the trees in a 15-ha sugar bush near Sandbanks Provincial Park sustained 20% foliar damage.

Table 6. Summary of jack pine sawfly evaluations in six jack pine plantations in the Eastern Region of Ontario in 1989 (evaluations based on the examination of 150 trees)

Location (Twp)	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees affected (%)	Avg defoliation per affected tree (%)
Carleton Place District					
Montagne	3.5	900	1	100	80
Dalhousie	2.2	1,000	12	10	10
Napanee District					
Ernestown	2.1	800	3	5	10
Kingston	2.0	1,200	1	100	60
Portland	2.0	1,200	12	90	78
Tweed District					
Hungerford	2.8	1,200	18	80	70

Minor Insects

Maple Trumpet Skeletonizer, *Epinotia aceriella* (Clem.)

A slight reduction in the occurrence of this insect was apparent through the region in 1989. Light foliar damage (<5%) was observed primarily on 1- to 5-m regeneration through a 15-ha maple woodlot near the town of Athens in Rear of Yonge and Escott Township, Brockville District. The highest populations were observed in two areas of Napanee District for the third consecutive year. In Presqu'ile Provincial Park in Brighton Township, approximately 90% of the maple trees in a 20-ha area sustained severe damage to 60% of their foliage. In Hallowell Township on Prince Edward County Road 12, 60% of the trees in a 10-ha sugar bush sustained similar foliar damage.

Bark Beetles, *Ips pini* (Say), *Hylurgops pinifex* (Fitch), *Pityogenes hopkinsi* Swaine and *Trypodendron rufitarsis* (Kby.)

In 1989, red pine and white pine stands that were on shallow soils or were exposed to drought conditions, winter drying and/or salt damage became attractive to active populations of bark beetles. These bark beetles quickly began feeding and multiplying under the bark, causing rapid decline of the trees. Pockets of semimature and mature dead and declining trees were observed at 10 locations across the region (Fig. 5). These areas contained between 3 and 80 affected trees, generally along stand edges facing roadsides and ridges.

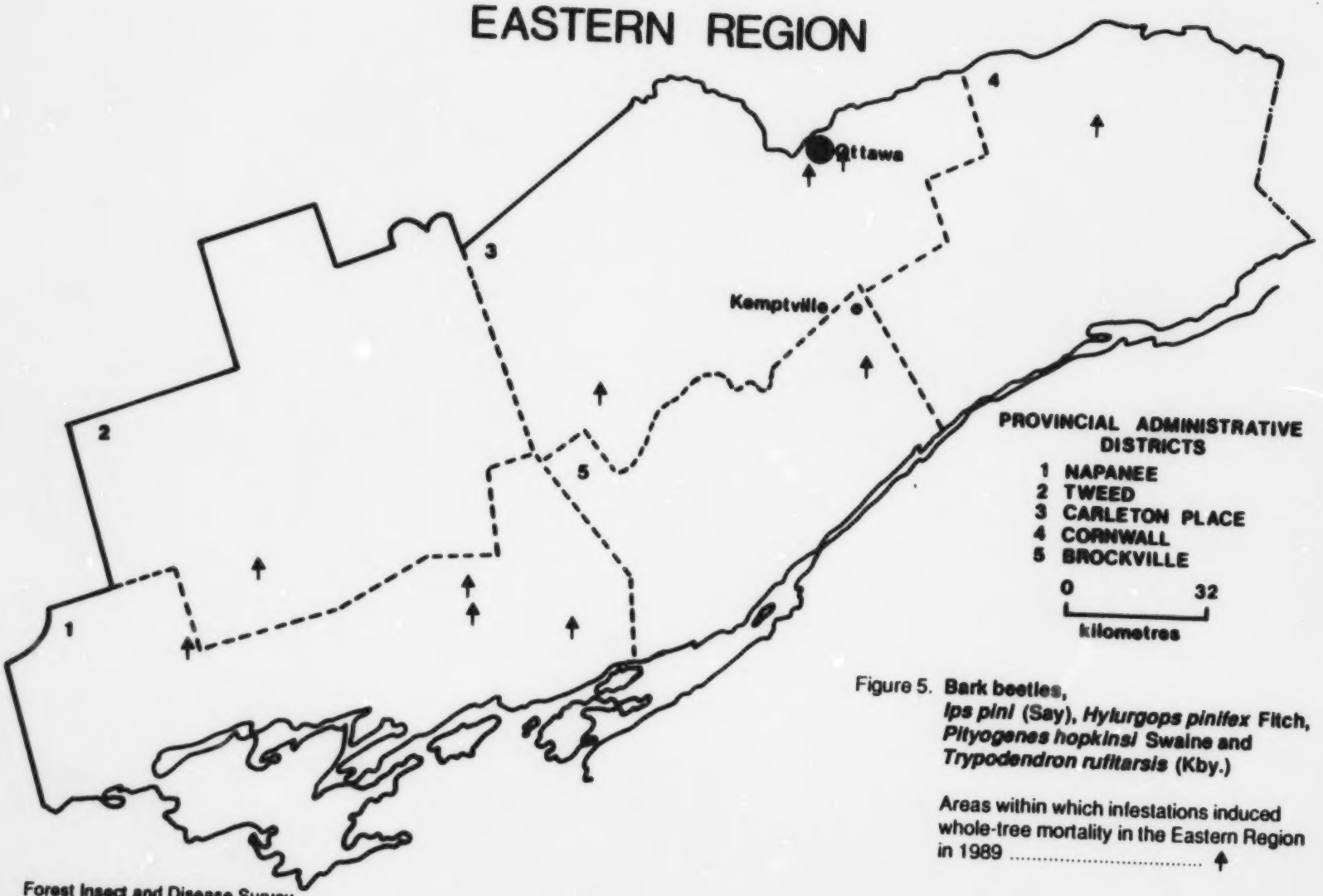


Figure 5. **Bark beetles,**
***Ips pini* (Say), *Hylurgops pinifex* Fitch,**
***Pityogenes hopkinsi* Swaine and**
***Trypodendron rufitarsis* (Kby.)**

Areas within which infestations induced whole-tree mortality in the Eastern Region in 1989 .....

Table 7. Other forest insects

Insect	Host(s)	Remarks
Caliroa fasciata (Nort.) Oakslug sawfly	wO	Two single 2.5-m trees were 100% skeletonized beside Hwy 38, Portland Twp, Napanee District.
Cameraria ostryarella (Cham.) Ironwood leafblotchminer	I	Foliar browning averaged 50% on regeneration in Murphy's Point Provincial Park, Carleton Place District.
Coleophora pruniella Clem. Cherry casebearer and *C. comptoniella* (McD.) Lesser birch casebearer	wB	Large numbers of casebearers caused an average of 10% foliar damage to Lake Ontario shoreline trees in Sandbanks Provincial Park, Napanee District and at various points in Carillon Provincial Park in Cornwall District.
Corthylus punctatissimus (Zimm.) Pitted ambrosia beetle	sM	Approximately 56% of the 0.5-m regeneration was girdled in a 2-ha area of the Mill Pond Conservation Area, South Elmsley Twp, Brockville District.
Diprion similis (Htg.) Introduced pine sawfly	wP	Six 3.0-m trees contained single larvae in a North Fredericksburgh Twp plantation, Napanee District.
Epinotia timidella (Clem.) Oak trumpet skeletonizer and *Stigmella latifasciella* (Cham.) Oak serpentine leafminer	rO, wO	A complex of insects again caused foliar browning ranging from 50 to 100% on occasional roadside and ornamental trees throughout the region.
Eucosma gloriola Heinr. Eastern pine shoot borer	wP	In four plantations surveyed across the region, damage to lateral shoots averaged <1%. Trees ranged from 0.5 m to 10 m in height.

(cont'd)

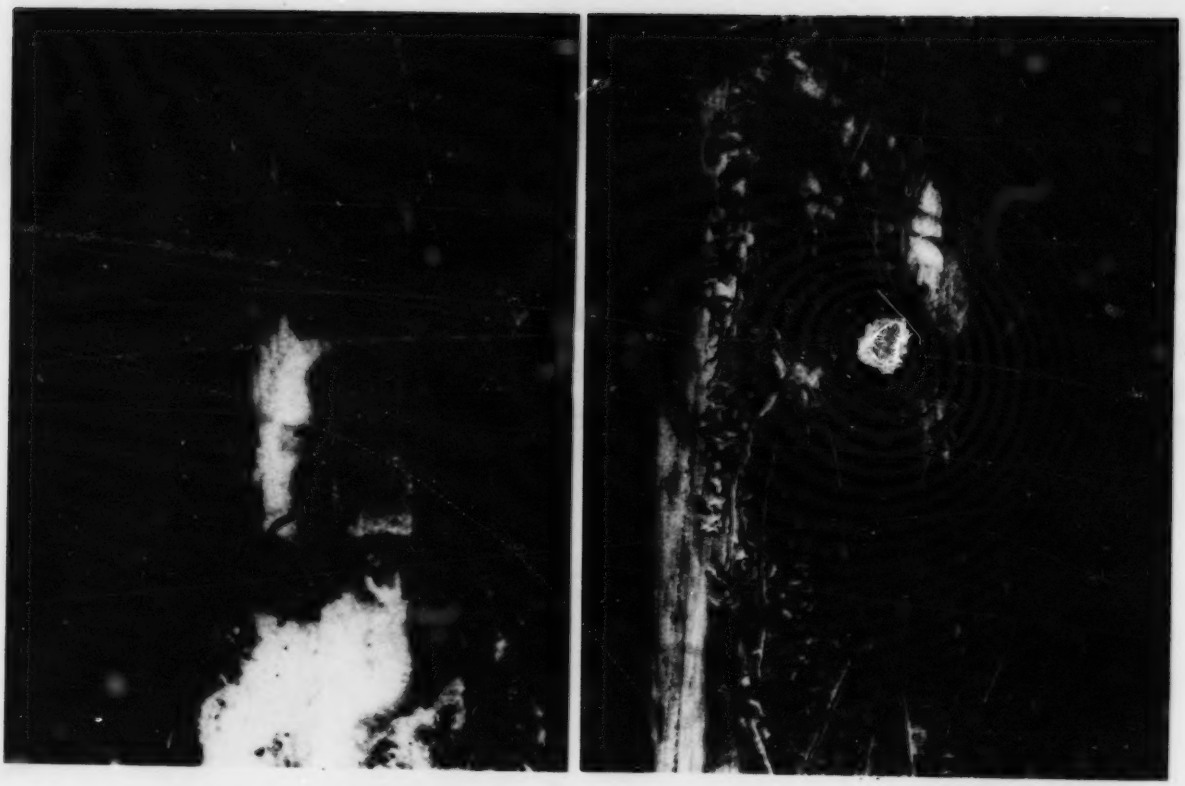
Table 7. Other forest insects (cont'd)

Insect	Host(s)	Remarks
Fenusa ulmi Sund. Elm leafminer	wE	Regenerating pole-sized trees sustained 80 to 100% foliar damage in Murphy's Point Provincial Park, Carleton Place District and Charleston Lake Provincial Park, Brockville District.
Leucoma salicis (L.) Satin moth	siPo	Approximately 20 stems of roadside regeneration were 60% defoliated along Hwy 401 in Tyendinaga Twp, Napanee District.
Neodiprion lecontei Fitch Redheaded pine sawfly	rP	A 2.0-ha plantation of 2-m trees contained single colonies that caused an average of 10% defoliation to 2% of the trees in Oxford on Rideau Twp, Brockville District.
Neodiprion sertifer (Geoff.) European pine sawfly	scP, rP	Increased populations caused variable damage to small stands in Napanee, Brockville, Carleton Place and Tweed districts. Defoliation ranged from 10 to 50%.
Pissodes strobi (Peck) White pine weevil	wP	Terminal damage ranged from <1% to 3% and averaged 2% in six plantations of various sizes located across the region.
Plagiodera versicolora (Laich.) Imported willow leaf beetle	Wi	This insect caused 100% foliar browning on 0.5 km of stream-side trees in Murphy's Point Provincial Park, Carleton Place District; many roadside trees along Hwys 401 and 16 in Brockville District sustained various levels of foliar damage.

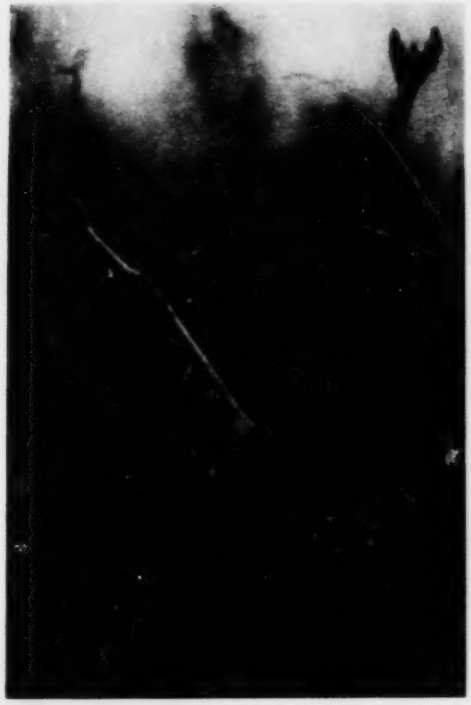
(cont'd)

Table 7. Other forest insects (concl.)

Insect	Host(s)	Remarks
Rhyacionia buoliana (D. & S.) European pine shoot moth	muP	Approximately 62% of 100 young 1-m roadside trees planted along Hwy 401 in Tyendinaga Twp, Napanee District contained an average of three damaged lateral shoots each.
Rhynchaenus rufipes (LeC.) Willow flea weevil	blWi	Complete foliar browning of mature host trees occurred in Silver Lake Provincial Park (approx. 20 trees) and Sharbot Lake Provincial Park (approx. 10 trees).
Sparganothis acerivorana MacK. Maple leafroller	maple	Occasional trees contained 3-5 rolled leaves per branch in Fitzroy Provincial Park, Carleton Place District.
Thripidea Thrips	jP, Ba	A Christmas tree plantation contained foliar discoloration on the tops of approximately 15 pine trees, each 2 m high. Pole-sized basswood (*Tilia americana* L.) trees contained chlorotic stippling damage on 100% of the foliage in Murphy's Point Provincial Park. This foliage later assumed a black and curled appearance similar to that caused by frost damage.
Zale sp. probably *galbanata* Morr. Maple false looper	Manitoba maple	Approximately five understory trees along Prince Edward County Rd 12 in Hallowell Twp, Napanee District were totally defoliated.
Zellaria haimbachi Bsk. Pine needle sheathminer and *Exoteleia pinifoliella* (Cham.) Pine needleminer	jP	For the second consecutive year, 100% of the 2-m-tall trees in a 5.0-ha plantation suffered 78% foliar damage, and 100% of the 2-m-tall trees in an adjacent 2-ha plantation sustained 40% foliar damage.



Many stands containing trees stressed by drought or some other factor soon succumbed to the onslaught of bark beetles such as *Ips pini* (Say).



Hatching of forest tent caterpillars (*Malacosoma disstria* Hbn.) occurred before the maple buds began expanding (upper left). Larvae soon made up for lost time on expanding leaflets (upper right), severely defoliating forested areas such as this sugar maple (*Acer saccharum* Marsh.) bush in the Napanee District (bottom).

TREE DISEASES

Major Diseases

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.)

Aerial and ground surveys again failed to establish the presence of this disease in the region in 1989. Twenty-four plantations were ground surveyed (500 trees/site) and numerous areas contained abnormalities that were detected from the air. The most frequent causes of these discolored areas were bark beetle infestations and porcupine feeding damage.

White Pine Blister Rust, *Cronartium ribicola* J.C. Fischer

An increase in infections has occurred through the region, perhaps because of favorable climatic conditions over the past two seasons (i.e., a hot, humid spring). Infection levels ranged from 1 to 20%. In a single 1-ha plantation, 10.7% of the 1-m-tall trees contained branch infections and 9.3% succumbed to stem infections in Lots 1 and 2 on Concession IV in Rawden Township, Tweed District. Many roadside trees of various sizes along Highway 7 between Perth and Kaladar and along Highway 401 from Brockville to Kingston displayed top and branch mortality.

Beech Bark Disease, *Nectria galligena* Bresad.

In 1988, the first association of a beech bark disease and the insect *Cryptococcus fagisuga* Linding. was recorded by FIDS staff at Presqu'ile Provincial Park (see Beech Scale). In 1989 the fungus *N. galligena* was recovered from a second mature beech (*Fagus* spp.) tree in the same area, which was infested with the beech scale. Both trees are newly infected and contain the early symptoms of small cracks bearing reproductive fungi. Surveys of stands containing beech will continue in 1990.

The classic and most serious beech bark disease, *N. coccinea* (Pers.) Fr. var. *faginata* Lohman, Watson and Ayers, though not yet found in Ontario, has caused extensive cankering and mortality in neighboring Quebec, the Maritime provinces and New York State.

Table 8. Other forest diseases

Organism	Host(s)	Remarks
Coleosporium asterum (Dietel) Sydow Pine needle rust	rP	A single 2-m tree on Cosburn Rd in Nepean Twp, Carleton Place District had 25% of its lower foliage affected
Leucostoma kunzei (Fr.) Munk Cytospora canker	wS	In a plantation of 1.5-m-tall Christmas trees in Rideau Twp, Carleton Place District, six (<1%) contained stem cankers.
Melanconis juglandis (Ell. & Ev.) Graves Butternut canker	Bu	Two mature roadside trees in Lot 16, Conc. IX in Bedford Twp, Napanee District contained cankers on 50% of their branches.
Septoria musiva Peck. Septoria canker	Poplar	In a 1-ha area of approx. 10,000 4-m-high trees near the town of Westport in Brockville District, there was 1% mortality.
Sphaeropsis sapinea (Fr.) Dyko & B. Sutton Tip blight	rP, ScP	Flagging of branch tips was commonly seen (<10%) on scattered trees along the Long Sault Parkway, Cornwall District.

ABIOTIC DAMAGE

Cedar Browning

During late May and early June, foliar browning occurred throughout the region. This sudden necrosis of foliage is thought to be a result of several stressing factors that have been present since 1988. Severe drought conditions during the summer of 1988 accompanied by a heavy cone crop and a complex of cedar leafminers created thin crowns and overall stressful conditions. Severe moisture loss during the cold, dry winter months incited a sudden dieback and browning that caused light levels of branch and tip mortality, particularly in the Brockville, Cornwall and Carleton Place districts. New growth was evident beginning in late June, an indication that most stands were recovering.

FOREST HEALTH

Hardwood Decline

Hardwood decline was identified in six areas within the region in 1989. Poorly drained areas, mountainous ridges, hilltops containing shallow soils overlying Canadian Shield outcroppings, and drought-like conditions in 1988 were probably responsible for the stressful conditions that caused a rapid decline and mortality of approximately 10,991 ha of hardwoods (Fig. 6). In the Cornwall District an area of approximately 4,200 ha in Osnabruck Twp, east of Grantley and north of North Valley, contained smaller pockets of declining aspen (*Populus* spp.), maple and birch, on poorly drained soils. Brockville District contained two small pockets (62 ha and 57 ha) southwest of the town of Freeland in Bastard Township. Both areas are situated on ridges and contained dead maple, birch and aspen. In the Carleton Place District two areas south of the Mississippi River (668 ha and 491 ha) in Dalhousie Township consisting of red maple (*Acer rubrum* L.), poplar and white birch (*Betula papyrifera* Marsh.) on marginal lowland/swamp also showed evidence of disease. The largest areas of decline were found in the Napanee District in pockets of mixed hardwoods near the shoreline of Bob's Lake in Bedford Township (totaling approximately 3,050 ha) and within Frontenac Provincial Park around Big Salmon and Big Clear Lakes (totaling approximately 2,100 ha). In the Tweed District, a small area on Nowlans Mountain in Ashby Township contained an additional 363 ha of poplar, birch and maple in a declining state. Ground evaluations of all situations described above will be continued in 1990.

Maple Health Surveys

Since 1987, 10 sugar maple (*Acer saccharum* Marsh.) woodlots have been assessed annually across the region for general conditions and health (Fig. 7). In 1989, assessments revealed that current branch mortality had remained relatively light, with 91% of 250 trees suffering <5% dieback. Cumulative branch mortality increased slightly, with 80% of the trees containing 6-20% dieback (Table 9a).

Insects accounted for an average of <10% defoliation in 6 of 10 plots; the principal defoliators were the maple trumpet skeletonizer, forest tent caterpillar, gypsy moth and maple leafcutter. In Napanee District, the Cramahe Township plot suffered an average of 20% foliar damage caused by the forest tent caterpillar and three plots in Brighton Township sustained an average of 25% defoliation caused by the maple trumpet skeletonizer.

An additional 10 plots were established in 1989 in rural (i.e., windrows, roadsides, driveways, etc.) and urban (i.e. city parks, shade trees, boulevard trees, etc.) areas throughout the region. The majority of these trees were open-growing and overmature. Current branch mortality was estimated to be higher here than in the woodlot plots (Table 9a), but generally remained under 20% (Table 9b). Most trees

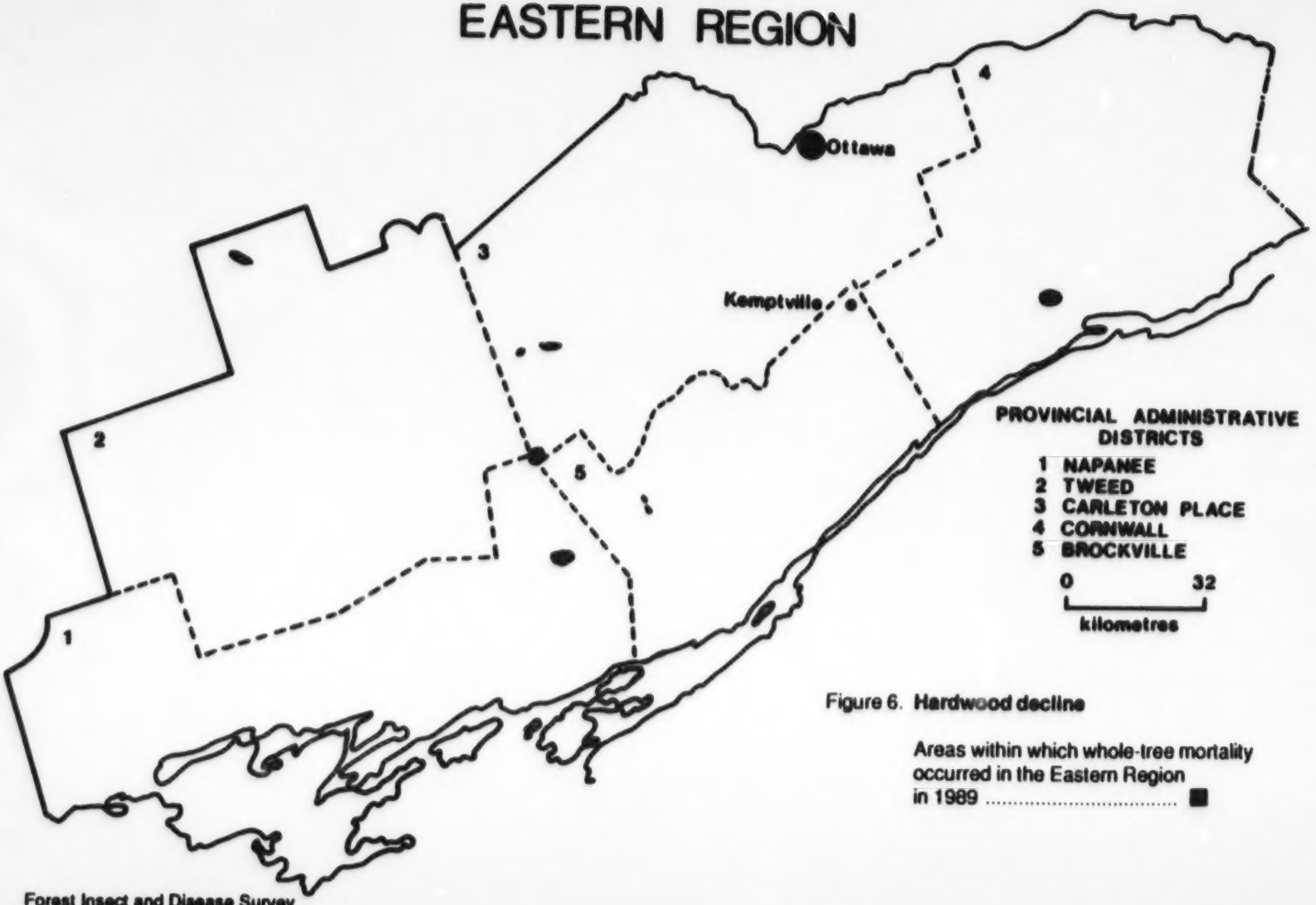


Figure 6. **Hardwood decline**

Areas within which whole-tree mortality occurred in the Eastern Region in 1989 ..... ■

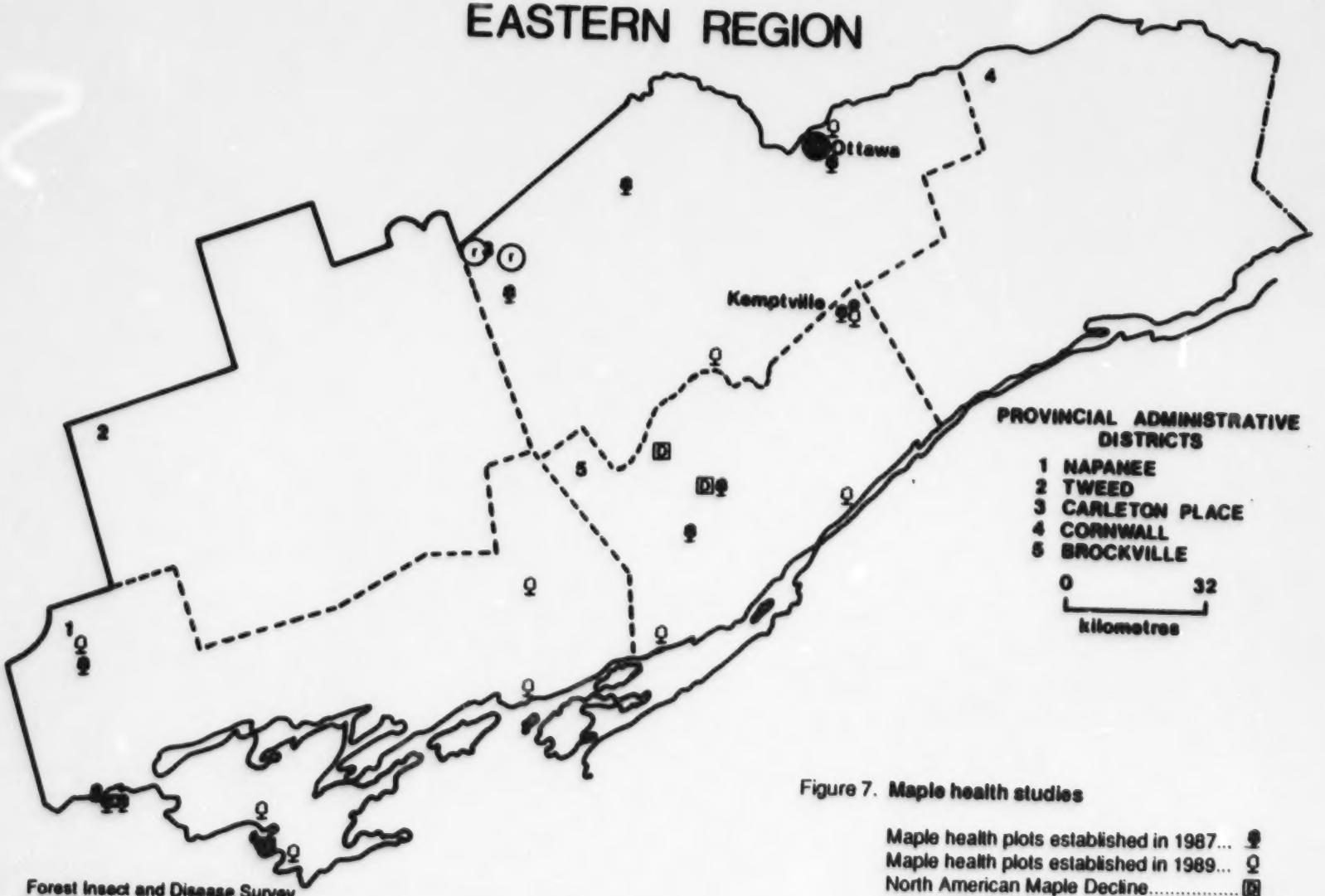


Figure 7. **Maple health studies**

Maple health plots established in 1987...
Maple health plots established in 1989...
North American Maple Decline...
Red oak health plots...

Table 9(a). Annual summary of results from 10 plots established in woodlots in 1987 to monitor sugar maple health in the Eastern Region of Ontario (data based on the examination of a minimum of 25 host trees per location)

Location (Twp)	Avg DBH (cm)	Avg ht (m)	Estimated stand area (ha)	Year	No. of trees with crown dieback[a]											
					Current						Cumulative					
					0	1	2	3	4	Trees dead	0	1	2	3	4	Trees dead
Brockville District																
Oxford on Rideau	35.6	24	15	1987	21	4	0	0	0	0	12	13	0	0	0	0
				1988	25	0	0	0	0	0	9	16	0	0	0	0
				1989	25	0	0	0	0	0	5	20	0	0	0	0
Rear of Leeds & Lansdowne	66.4	28	2	1987	21	4	0	0	0	0	16	8	1	0	0	0
				1988	18	7	0	0	0	0	12	12	1	0	0	0
				1989	20	2	0	0	0	3[b]	0	20	2	0	0	3[b]
Rear of Yonge & Escott	33.6	21	30	1987	23	2	0	0	0	0	18	7	0	0	0	0
				1988	25	0	0	0	0	0	14	11	0	0	0	0
				1989	23	2	0	0	0	0	4	21	0	0	0	0
Carleton Place District																
Nepean	37.1	20	4	1987	23	2	0	0	0	0	23	2	0	0	0	0
				1988	22	3	0	0	0	1	20	4	1	0	0	1
				1989	23	2	0	0	0	1	8	16	0	0	0	1
Pakenham	50.5	25	15	1987	22	3	0	0	0	0	12	11	2	0	0	0
				1988	20	5	0	0	0	0	4	19	2	0	0	0
				1989	21	4	0	0	0	0	1	22	2	0	0	0
Lavant	37.6	22	20	1987	19	6	0	0	0	0	16	8	1	0	0	0
				1988	16	9	0	0	0	0	12	13	0	0	0	0
				1989	25	0	0	0	0	0	0	23	2	0	0	0

(cont'd)

Table 9(a). Annual summary of results from 10 plots established in woodlots in 1987 to monitor sugar maple health in the Eastern Region of Ontario (data based on the examination of a minimum of 25 host trees per location) (concl.)

Location (Twp)	Avg DBH (cm)	Avg ht (m)	Estimated stand area (ha)	Year	No. of trees with crown dieback[a]											
					Current						Cumulative					
					0	1	2	3	4	Trees dead	0	1	2	3	4	Trees dead
Napanee District																
Brighton, Staff House	40.0	20	1	1987	23	2	0	0	0	0	14	11	0	0	0	0
				1988	23	2	0	0	0	0	10	14	1	0	0	0
				1989	23	2	0	0	0	0	5	20	0	0	0	0
Brighton, Campsite	44.0	21	1	1987	24	1	0	0	0	0	20	4	1	0	0	0
				1988	21	4	0	0	0	0	3	22	0	0	0	0
				1989	25	0	0	0	0	0	3	22	0	0	0	0
Brighton, Entrance	42.0	20	2	1987	25	0	0	0	0	0	23	2	0	0	0	0
				1988	21	4	0	0	0	0	12	13	0	0	0	0
				1989	19	6	0	0	0	0	3	22	0	0	0	0
Cramahe	36.0	18	2	1987	25	0	0	0	0	0	24	1	0	0	0	0
				1988	25	0	0	0	0	0	14	11	0	0	0	0
				1989	25	0	0	0	0	0	12	13	0	0	0	0
% of total trees				1987	90	10	0	0	0	0	71	27	2	0	0	0
				1988	85	14	0	0	0	1	43	54	0	0	0	1
				1989	91	7	0	0	0	2	16	80	2	0	0	2

[a] Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >61%

[b] Felled tree(s)

Table 9(b). Summary of results from 10 plots established in rural and urban areas in 1989 to monitor sugar maple health in the Eastern Region of Ontario (data based on the examination of a minimum of 25 host trees per location)

Location (Twp)	Rural/ Urban	Avg DBH (cm)	Avg ht (m)	No. of trees with crown dieback[a]											
				Current						Cumulative					
				0	1	2	3	4	Trees dead	0	1	2	3	4	Trees dead
Brockville District															
Oxford on Rideau	U	55	19	19	4	2	0	0	0	6	15	3	0	1	0
Elizabethtown	U	64	23	17	8	0	0	0	0	6	19	0	0	0	0
Front of Leeds & Lansdowne	U	59	24	11	13	1	0	0	0	3	19	3	0	0	0
Carleton Place District															
North Elmsley	U	68	22	17	8	0	0	0	0	1	21	3	0	0	0
Gloucester	U	46	21	21	3	1	0	0	0	11	14	0	0	0	0
Napanee District															
Seymour	U	68	21	9	14	2	0	0	0	1	20	4	0	0	0
Hallowell	R	59	26	4	17	4	0	0	0	1	14	10	0	0	0
Loughborough	R	70	22	13	9	3	0	0	0	1	18	5	1	0	0
Kingston	R	53	23	14	10	1	0	0	0	11	13	1	0	0	0
Hillier	R	67	19	6	13	5	1	0	0	3	11	7	2	2	0
AVERAGE		61	22												
% of total trees				52	40	7.6	0.4	0	0	18	66	14	1	1	0

[a] Dieback classification: 0 = 5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >61%

assessed (66%) contained cumulative dieback in the 6-20% range while 16% of the trees had <20% dieback and were in various stages of decline. Insect damage in these plots was generally less than 5%, with the principal defoliators being the maple trumpet skeletonizer, forest tent caterpillar, gypsy moth and maple leafcutter. The exception was in the Seymour Township plot, where an average of 50% of the foliage was destroyed by the forest tent caterpillar.

North American Maple Project

This project was established in 1988 under a cooperative program with the United States Forest Service. Three plots located in the Brockville and Napanee districts of the Eastern Region were reassessed in 1989 (Fig. 7, Table 10). All three plots have remained virtually unchanged, with 90% of the trees containing less than 15% branch mortality. The South Burgess Township plot has declined slightly, with 52% of 42 trees containing 6-15% crown dieback in 1989 in comparison with only 13% in this class in 1988 (Table 10). This same plot has a history of heavy tapping, and maple sugar demonstrations and operational tours are conducted regularly. Assessments of all plots will continue in 1990.

Oak Health

Red oak (*Quercus rubra* L.) branch mortality estimates from two plots in Lavant Township, Carleton Place District have remained consistently low since 1977 (Fig. 7). Current branch mortality at the Joe Lake plot (Table 13) increased slightly, with 86% of the trees rated in the 0-20% class. Total cumulative branch mortality has remained fairly constant, with 75% of the trees in the 6-40% dieback range. Gypsy moth was the principal defoliator, accounting for an average of 14% defoliation. The situation is similar in the Flower Station plot, with 86% of 100 trees suffering current dieback in the 0-20% range and 82% suffering cumulative branch mortality in the 0-40% range. Defoliation by insects averaged 4%, with gypsy moth once more the principal defoliator. Mortality has increased slightly to 1% at the Joe Lake plot and 2% at the Flower Station plot.

Table 10. Summary of sugar maple crown conditions assessed at three North American maple plots established in 1988 and 1989 in the Eastern Region.

Location	Avg DBH (cm)	Year	No. of trees examined	Total percentage of crown dead												Trees dead	Trees blown down or cut
				0	1-5	6-15	16-25	26-35	36-45	46-55	56-65	66-75	76-85	86-95	96-100		
Brockville District																	
South Burgess[a]	32.5	1988	42	0	31	7	2	2	0	0	0	0	0	0	0	0	0
		1989	42	0	14	22	5	1	0	0	0	0	0	0	0	0	0
Yonge and Escott[b]	19.0	1988	60	0	44	16	0	0	0	0	0	0	0	0	0	0	0
		1989	60	0	49	11	0	0	0	0	0	0	0	0	0	0	0
Napanee District																	
Hallowell[c]	25.0	1988	30	0	15	14	1	0	0	0	0	0	0	0	0	0	0
		1989	30	0	17	11	2	0	0	0	0	0	0	0	0	0	0

[a] Currently tapped for maple syrup

[b] Undisturbed woodlot

[c] Previously tapped for maple syrup

Table 11. A 13-year summary of data collected from two red oak plots established in 1977 in Carleton Place District in the Eastern Region of Ontario (based on the examination of 100 tagged trees per location)

Location	Avg DBH of trees (cm)	Stand size (ha)	Year	Current Dieback Classes[a] (% of trees)						Cumulative Dieback Classes[b] (% of trees)					
				0	1[c]	2	3	4	New trees dead	0	1	2	3	4	Total trees dead
Carleton Place District															
Lavant Twp - Plot 1	24.0	40.0		-	46	38	12	4	0	-	-	-	-	-	0
				-	21	59	13	7	0	-	-	-	-	-	0
				-	5	51	32	8	4	-	-	-	-	-	4
				-	7	41	36	11	1	-	-	-	-	-	5
				-	11	33	37	12	2	-	-	-	-	-	7
				-	6	32	40	15	0	-	-	-	-	-	7
				-	7	33	40	13	0	-	-	-	-	-	7
	26.3		1984	10	51	20	6	6	0	0	26	43	15	5	7
			1985	36	35	14	7	1	0	0	26	47	15	5	7
	26.5		1986	43	35	11	1	0	3	0	30	42	12	6	10
			1987	56	31	2	0	0	1	3	40	32	11	3	11
			1988	51	36	1	1	0	0	6	56	23	4	0	11
			1989	28	58	1	1	0	1	2	49	26	11	0	12
Lavant Twp - Plot 2 Flower Station	19.0	15.0		-	28	50	11	1	0	-	-	-	-	-	0
				-	14	72	10	4	0	-	-	-	-	-	0
				-	5	73	18	2	2	-	-	-	-	-	2
				-	2	53	33	7	3	-	-	-	-	-	5
				-	2	41	40	8	4	-	-	-	-	-	9
	20.0			-	0	40	41	10	0	-	-	-	-	-	9
				-	0	49	31	10	1	-	-	-	-	-	10

(cont'd)

Table 11. A 13-year summary of data collected from two red oak plots established in 1977 in Carleton Place District in the Eastern Region of Ontario (based on the examination of 100 tagged trees per location) (concl.)

Location	Avg DBH of trees (cm)	Stand size (ha)	Year	Current Dieback Classes[a] (% of trees)						Cumulative Dieback Classes[b] (% of trees)					
				0	1[c]	2	3	4	New trees dead	0	1	2	3	4	Total trees dead
Lavant Twp - Plot 2 (cont'd)															
	21.4		1984	19	48	18	3	2	0	-	19	49	19	3	10
			1985	48	37	3	0	2	0	0	31	47	11	1	10
	21.9		1986	42	39	8	0	0	1	0	39	44	4	2	11
			1987	66	20	3	0	0	0	6	51	25	3	4	11
			1988	63	26	0	0	0	0	7	58	22	1	1	11
			1989	27	59	1	0	0	2	1	70	11	5	0	13

[a] 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >61%

[b] cumulative dieback not estimated prior to 1984

[c] 1977-1983: Class 1 = 0-20% at both plots

Table 12. Summary of the results of white pine plantation surveys conducted at six locations in the Eastern Region in 1989 (counts based on the examination of 150 trees at each location)

Location (Twp)	Avg ht of trees (m)	Estimated stand area (ha)	Estimated no. of trees per ha	White pine weevil	Eastern pine shoot borer		White pine blister rust	
				Leaders attacked (%)	Leaders (%)	Laterals (%)	Trees affected (%)	Stem cankers (%)
Brockville District								
South Gower	2.5	2	1,200	1	0	0	5	<1
Carleton Place District								
Fitzroy	7.0	5	600	0	0	0	0	0
Nepean	2.0	1	1,000	2	0	<1	2	0
Napanee District								
Rawdon	1.5	1	1,200	<1	0	0	20	9
North Fredericksburgh	3.2	5	1,500	3	0	0	1	0
Tweed District								
Hungerford	7	1	1,000	<1	0	2	0	0

SPECIAL SURVEYS

Eastern White Pine Plantations

Six plantations randomly selected from across the region were evaluated for damage inflicted by insects, diseases and abiotic agents (Fig. 8). Two plantations were randomly selected from each of the following height classes: 0.5-2.0 m, 2.1-6.0 m, and >6.0 m. Evaluations consisted of the examination of 150 trees at each plantation during visits in the months of June and August. The stands were assessed for the presence of the following insects and diseases:

Insects: Pine spittlebug, *Aphrophora cribrata* (Wlk.), eastern pine shoot borer, pine bark adelgid, *Pineus strobi* (Htg.) and white pine weevil.

Diseases: Armillaria root rot, *Armillaria ostoyae* (Romagn.) Herink and white pine blister rust.

The following pests were not found in the current survey:

Insects: Pine spittlebug and pine bark adelgid.

Diseases: Armillaria root rot.

Pests encountered during assessments included:

Insects: Introduced pine sawfly, gypsy moth, adelgids, white pine aphid, *Cinara strobi* (Fitch) and bark beetles, Scolytidae.

Abiotic: Emergence tip burn - possibly ozone damage.

The major pest of white pine plantations assessed was found to be the white pine blister rust. In Rawdon Township, Napanee District, approximately 20% of the 1.5-m trees were affected, with 9% of them containing stem cankers. Infection levels ranged from 1 to 5% at three other plantations (Table 12). White pine weevil damage ranged from 1 to 3% at five plantations. Low levels of the eastern pine shootborer affected the lateral branches in two plantations. The introduced pine sawfly, gypsy moth, white pine aphids and bark beetles were commonly found in low numbers. An abiotic condition described as emergence tip burn was observed at three plantations; foliar browning ranged from 10% of 3 trees at the North Fredericksburgh Township plot to 50% of 13 trees at the South Gower Township plot.

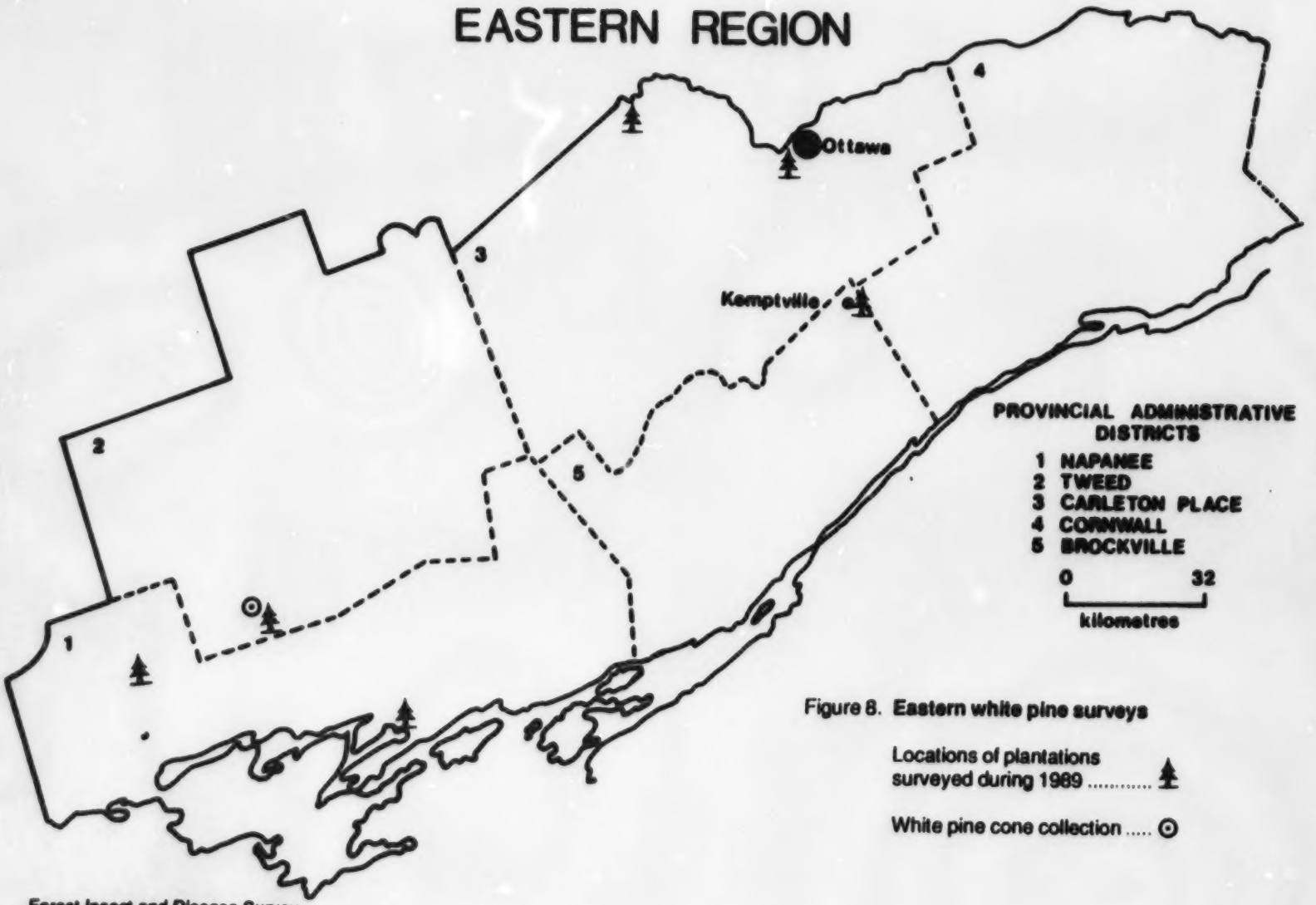


Figure 8. **Eastern white pine surveys**

Locations of plantations surveyed during 1989 .....

White pine cone collection .....

Eastern White Pine Cone and Seed Pests

For a better understanding of the possible impact of cone pests, collections for analysis are made by FIDS staff across Ontario each year. In 1989 white pine cones were sampled from 7-m-tall trees in a plantation in Hungerford Township, Tweed District. Of the 100 2-year-old cones collected, 76 were damaged and suffered a 73% loss of viable seed. Damage was caused by the white pine cone borer, *Eucosma tocullionana* Heinr. (71%) and an unknown lepidopterous insect (5%).

Beech Scale, *Cryptococcus fagisuga* Linding.

In 1987 two beech (*Fagus grandifolia* Ehrh.) trees near the Gananoque Golf Course in Brockville District were discovered to be infested with this insect. This represented a new distribution record, and the first observation of beech scale by FIDS staff in the Eastern Region. In 1988 this small infestation spread to approximately 20 mature trees scattered through a 3-ha stand along the St. Lawrence River. A new infestation was discovered in 1988 along the St. Lawrence River in Presqu'ile Provincial Park, Napanee District, where 18% of the mature beech scattered through a 20-ha stand were affected.

The infestation continued in both areas in 1989 but at reduced levels. The Gananoque Golf Course site contained only three infested mature beech trees (approximately 2% of the beech growing there), and the Presqu'ile Provincial Park site contained eight infested trees (approximately 5% of the beech growing there).

An associated fungus, *Nectria galligena* Bresad., was recorded from a new location at the Presqu'ile Provincial Park site.

Pear Thrips, *Taeniothrips inconsequens* (Uzel)

Historically a pest of fruit trees, this insect has recently become a serious forest pest in the northeastern area of the United States, where it causes damage to sugar maple, birch, ash, cherry and beech. The adult pear thrips averages less than 2 mm in length, and after overwintering in the soil, emerges in early spring to feed in swollen buds and flushing leaves. Most of the damage occurs at the time when leaves are expanding and succulent. Symptoms include chlorotic, tattered leaf margins that later present a wilted, puckered appearance. Crown dieback, top and whole-tree mortality have been documented over thousands of hectares in the United States south of eastern Canada since 1985.

In 1989 an extensive sampling program was initiated by FIDS across the range of sugar maple in an attempt to determine the status of this pest in Ontario. Bud and flower samples from over 100 locations were dissected and checked for the insect. Over all, 42 samples con-

tained pear thrips and nine of these were from the Eastern Region (see Fig. 9). Light levels of foliar damage were reported from Huronia, Maple, Niagara Falls and Cambridge districts in the Central Region, and from Napanee District in the Eastern Region.

Forest Tree Nursery Report

Transplanting failures, winter drying and other weather-induced anomalies all shared in causing low rates of conifer mortality at the G. Howard Ferguson Forest Station in 1989. Hybrid poplar in compartments sustained low levels of infection by the larch-poplar rust, *Melampsora medusae* Thüm., and septoria leaf spot, *Mycosphaerella populicola* G.E. Thompson. Leaf beetles, Chrysomelidae, caused light levels of feeding damage in Compartment 42. White grubs, *Phyllophaga* spp., caused approximately 25% mortality in a white spruce (*Picea glauca* [Moench] Voss) compartment in late August. Reduced levels of the root rot *Cylindrocladium floridanum* Sob. & C.P. Sym. were evident in planted red pine stock in 1989; only trace levels were identified.

Acid Rain National Early Warning System (ARNEWS)

The three plots established in 1984 in Rear of Yonge and Escott Township, Brockville District, in Gloucester Township, Carleton Place District, and in Hungerford Township, Tweed District, were all reassessed in 1989. No significant changes or symptoms were observed in any of the plot trees in these areas. Data are being summarized and will be available at a later date.

Climatic Data

Tables 13 and 14 contain mean monthly temperatures and total precipitation figures for two locations in the Eastern Region.

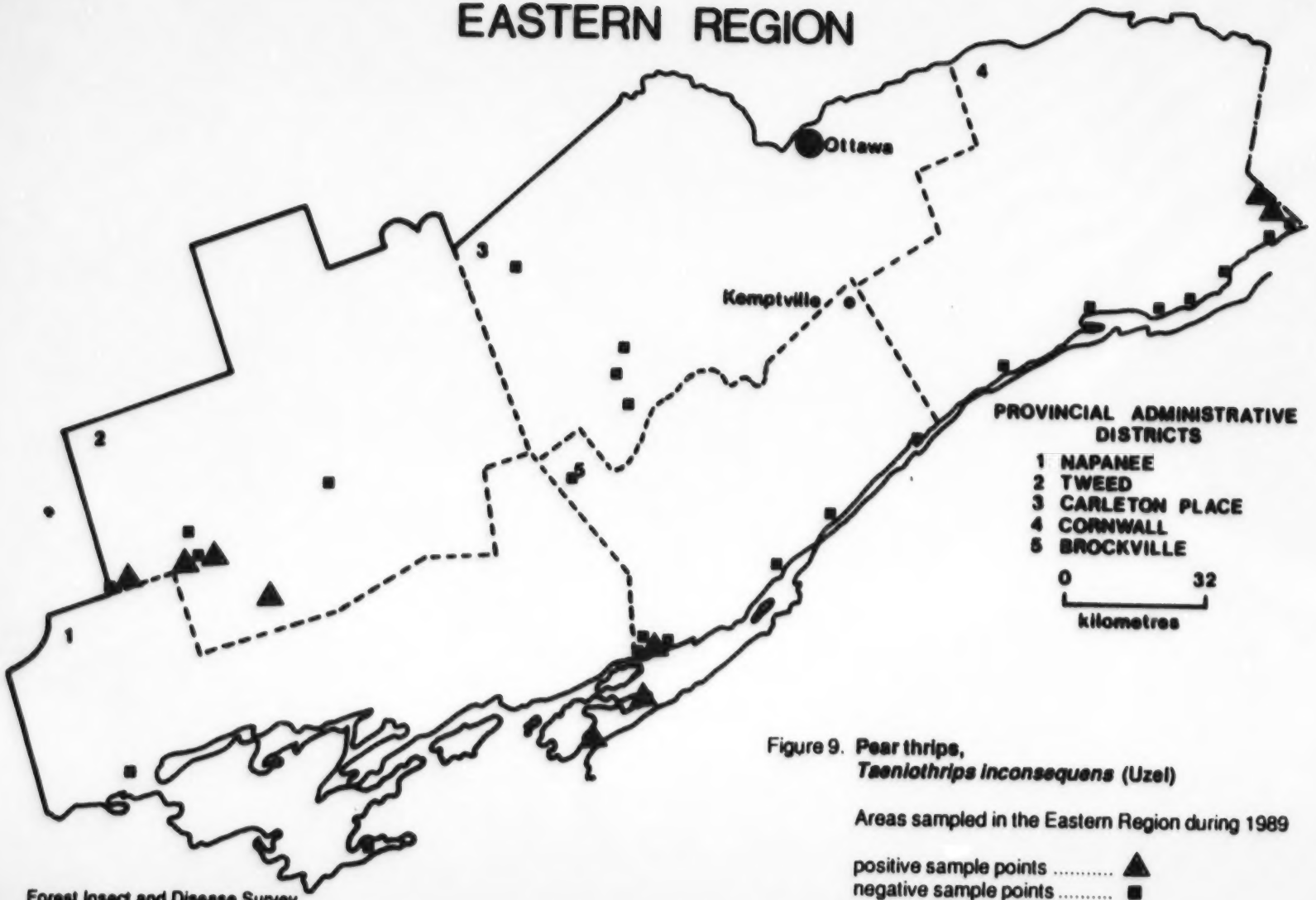


Figure 9. **Pear thrips,**
***Taeniothrips inconsequens* (Uzel)**

Areas sampled in the Eastern Region during 1989

positive sample points ..... ▲
negative sample points ..... ■

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Table 13. A comparison of 1989 mean temperature and total precipitation with their normal values (based on a 30-year period) (figures obtained from the Ottawa International Airport).

Month	Mean temp. 1989 (°C)	Normal temp. (°C)	Deviation from normal temp. (°C)	Total precip. 1989 (mm)	Normal precip. (mm)	Deviation from normal precip. (mm)
Jan.	-8.0	-10.9	+2.9	63.8	61.0	+2.8
Feb.	-9.6	-9.5	-0.1	30.8	60.3	-29.5
Mr.	-5.0	-3.0	-2.0	80.8	67.5	+13.3
April	4.5	5.6	-1.1	24.2	69.1	-44.9
May	14.1	12.8	+1.3	101.2	67.9	+33.3
June	18.9	18.0	0.9	70.8	73.4	-2.6
July	22.2	20.6	1.6	67.2	85.9	-18.7
Aug.	19.4	19.2	0.2	53.2	88.4	-35.2
Sept.	15.2	14.3	0.9	61.2	79.3	-18.1
Oct.	9.0	8.1	0.9	95.2	68.1	+27.1
Nov.	-1.4	1.2	-2.6	140.3	77.7	+62.6
Dec.	-16.6	-7.7	-8.9	45.8	80.7	-34.9

Table 14. A comparison of 1989 mean temperatures and total precipitation with their normal values (based on a 30-year period) (figures obtained from the Trenton Air Base).

Month	Mean temp. 1989 (°C)	Normal temp. (°C)	Deviation from normal temp. (°C)	Total precip. 1989 (mm)	Normal precip. (mm)	Deviation from normal precip. (mm)
Jan.	-3.8	-7.6	+3.8	46.2	68.9	-22.7
Feb.	-6.8	-6.5	-0.3	26.4	57.0	-30.6
Mar.	-3.4	-1.0	-2.4	57.2	72.0	-14.8
April	4.4	6.4	-2.0	34.3	76.1	-41.8
May	13.3	12.5	+0.8	86.2	73.0	+13.2
June	18.5	17.8	+0.7	84.2	63.7	+20.5
July	20.9	20.6	+0.3	20.0	60.9	-40.9
Aug.	19.1	19.7	-0.6	51.8	71.9	-20.1
Sept.	14.9	15.3	-0.4	75.0	72.8	+2.2
Oct.	8.6	9.2	-0.6	109.1	70.1	+39.1
Nov.	1.3	3.2	-1.9	156.2	86.1	+70.1
Dec.	-12.5	-4.5	-8.0	41.0	82.9	-41.9